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From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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FINLANDE

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year)

26.07.2004

Applicant's or agent's file reference
A1710PC

IMPORTANT NOTIFICATION

International application No.
PCT/FI 03/00244

International filing date (day/month/year)
28.03.2003

Priority date (day/month/year)
28.03.2002

Applicant
ABB OY et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



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REC'D 27 JUL 2004

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference A1710PC	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/FI 03/00244	International filing date (day/month/year) 28.03.2003	Priority date (day/month/year) 28.03.2002
International Patent Classification (IPC) or both national classification and IPC H02P3/22		
Applicant ABB OY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 23.09.2003	Date of completion of this report 26.07.2004
Name and mailing address of the International preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Drysedale, N Telephone No. +49 89 2399-2435



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/FI 03/00244

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-4, 6-15 as originally filed
5A filed with telefax on 05.07.2004

Claims, Numbers

1-22 filed with telefax on 05.07.2004

Drawings, Sheets

1/9-4/9, 6/9-9/9 as originally filed
5/9 received on 24.04.2003 with letter of 11.04.2003

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☒ the description, pages: 5
☐ the claims, Nos.:
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/FI 03/00244**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-22
	No: Claims	
Inventive step (IS)	Yes: Claims	1-22
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-22
	No: Claims	

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/FI 03/00244

V. Reasoned statement

2. Citations and explanations

1. Reference is made to the following documents:

- D1: US-A-4 338 525 (KILGORE LEE A) 6 July 1982 (1982-07-06)
- D2: DE 26 20 346 A (LINDE AG) 17 November 1977 (1977-11-17)
- D3: US 1 555 244 A (GAZDA) 29 September 1925 (1925-09-29)
- D4: US 5 184 049 A (KIUCHI) 2 February 1993 (1993-02-02)
- D5: WO 97/05691 A (FANUC LTD) 13 February 1997 (1997-02-13).

The documents D3 to D5 were not cited in the international search report.

- 2. The present application concerns a propulsion system wherein a propeller is driven by an electric motor having a permanent-magnet rotor. The propeller and its motor may be mounted in a pod, which can be rotated in azimuth by other permanent-magnet electric motors. The object is to reduce the speed of the propeller motor and/or to restrain the angular position of the rotor (claims 1, 17) and to reduce the speed and/or restrain the angular positions of the rotors of the azimuthal turning motors (claims 9, 20). It is thus essential to restrict the rotation of the propeller shaft and the extent to which the propeller pod may rotate in azimuth, in order to avoid damage due to uncontrolled rotation of the propeller or the pod if the propulsion unit is shut down (see description, page 4, last paragraph to page 5, second paragraph).
- 3. The basic idea underlying the present application is to provide dynamic braking for the motor by (a) disconnecting the stator windings from the power supply and (b) switching the windings so that they are short-circuited. This braking technique is well known per se, and is disclosed, for example, in documents D2 to D5. However, as the applicant points out, none of these documents discloses the use of the technique in conjunction with a permanent magnet motor. The documents D2 to D5 do not disclose the provision of a locking torque at zero speed. In contrast the performance of the claimed system is illustrated in Fig. 5 (see description, paragraph bridging pages 11-12).
- 4. The subject-matter of the independent claims 1, 9, 17 and 20 must therefore be regarded as novel and involving an inventive step in the light of the available prior art (Art. 33(2) & (3) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/FI 03/00244

5. The dependent claims define advantageous embodiments of the inventions of claims 1, 9, 17 & 20. Their subject-matter is therefore also considered to be new and inventive (Art. 33(2) & (3) PCT).
6. Industrial applicability (Article 33(4) PCT) is obvious for all claims.
7. Before entry into any subsequent regional phase the statement of invention in the description should be brought into consistency with the claims on file,

Accordingly, should there occur a break-down in the electric power supply to the motors in the turning arrangement for the propulsion unit, a sudden turning of the propulsion unit might cause additional damage to the propulsion device and possibly also to the vessel. If the propulsion device is free recklessly to turn this way and that, the maneuverability of the vessel is considerably impaired.

In propulsion units according to prior art, braking means operating mechanically have been devised. The object of the braking means is to prevent rotation of the propeller and to restrain the propeller essentially in a standard position or, respectively, to prevent the turning movement of the propulsion unit and to restrain the propulsion unit essentially in a standard position.

Summary of the present invention

The object of the present invention is to eliminate the disadvantages of prior art and to provide a novel solution for reducing and/or limiting the speed of a motor of a propulsion unit.

An object of the invention is to provide a solution, in which the use of any separate mechanical brake means and problems related to such means will be avoided.

An object of the invention is to provide a solution, in which the use of any separate mechanical brake means, as the propulsion unit is recklessly turning, can be avoided.

An object of the invention is to provide a solution, by which the reliability and the overall economy of the turning ma-

Patent claims

1. A system for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller (22), (29), a propeller motor (23), (30), said propeller motor containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), **characterized** in, that the system further comprises a switch arrangement (26), (33), which switch arrangement (26), (33) comprises means for disconnecting the propeller motor (23), (30) from the electrical power network and means for essentially short-circuiting the stator windings of the propeller motor (23), (30).

2. A system according to claim 1, **characterized** in that when a need for braking the propeller motor (23) is detected, first, the propeller motor (23) is disconnected from the electrical power network, after which the stator windings of the propeller motor (23) are switched into a short-circuit.

3. A system according to claim 1, **characterized** in that when a need for braking the propeller motor (30) is detected, first, the propeller motor (30) is disconnected from the electrical power network, after which the stator windings of the propeller motor (30) are switched into a short-circuit within the frequency converter (32).

4. A system according to claim 3, **characterized** in that the short-circuit is switched using semiconductors.

5. A system, according to claim 2, 3 or 4, **characterized** in that the short-circuit is implemented such, that the stator

windings of the propeller motor (23), (30) simultaneously are also connected to equipment ground.

6. A system according to any one of the preceding claims 2-5, **characterized** in that the switch arrangement (26), (33) is controlled by a control section (27), (34) of the frequency converter.

7. A system according to any one of the preceding claims 2-6, **characterized** in, that a synchronous motor (23), (30) is used as the propeller motor (23), (30) of the propulsion unit.

8. A system according to any one of the preceding claims 1-7, **characterized** in, that the braking system is implemented for switching more than one propulsion unit.

9. A system for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller (22), (29), motor units (10), (11) of the turning arrangement, said motor units (10), (11) containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), **characterized** in, that the system further comprises a switch arrangement (26), (33), which switch arrangement (26), (33) comprises means for disconnecting the motor units (10), (11) from the electrical power network and means for essentially short-circuiting the stator windings of motor units (10), (11).

10. A system according to claim 9, **characterized** in that when a need for braking the motor units (10), (11) is detected, first, the motor units (10), (11) are disconnected

from the electrical power network, after which the stator windings of the motor units (10), (11) are switched into a short-circuit.

11. A system according to claim 9, **characterized** in that when a need for braking the motor units (10), (11) is detected, first, the motor units (10), (11) are disconnected from the electrical power network, after which the stator windings of the motor units (10), (11) are switched into a short-circuit within the frequency converter (32).

12. A system according to claim 11, **characterized** in that the short-circuit is switched using semiconductors.

13. A system, according to claim 10, 11 or 12, **characterized** in that the short-circuit is implemented such, that the stator windings of the motor units (10), (11) simultaneously are also connected to equipment ground.

14. A system according to any one of the preceding claims 10-13, **characterized** in that the switch arrangement (26), (33) is controlled by a control section (27), (34) of the frequency converter.

15. A system according to any one of the preceding claims 10-14, **characterized** in, that synchronous motors (10), (11) are used as the motor units (10), (11) of the turning arrangement of the propulsion unit.

16. A system according to any one of the preceding claims 9-15, **characterized** in, that the braking system is implemented for switching more than one propulsion unit.

17. A method for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller (22), (29), a propeller motor (23), (30), said propeller motor containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), and a switch arrangement (26), (33) **characterized** in, that in the method according to the invention, first, a need for braking a propeller motor (23), (30) is detected (35), next, the propeller motor (23), (30) is disconnected (36) from the electrical power network (24), (31), after which the stator windings of the propeller motor (23), (30) are short-circuited (37).

18. A method according to claim 17, **characterized** in that before the stator windings of the propeller motor (23), (30) are short-circuited (37), a check is made to ensure (38), that the propeller motor (23), (30) is disconnected from the electrical power network.

19. Method, according to claim 17 or 18, **characterized** in that the braking method is implemented for switching more than one propulsion unit.

20. A method for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller (22), (29), motor units (10), (11) of the turning arrangement, said motor units (10), (11) containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), and a switch arrangement (26), (33) **characterized** in, that in the method according to the invention, first, a need for braking motor units (10), (11) is detected (35), next, the motor units (10), (11) are disconnected (36) from the

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electrical power network (24), (31), after which the stator windings of the motor units (10), (11) are short-circuited (37).

21. A method according to claim 20, **characterized** in that before the stator windings of the motor units (10), (11) are short-circuited (37), a check is made to ensure (38), that the motor units (10), (11) are disconnected from the electrical power network.

22. Method, according to claim 20 or 21, **characterized** in that the braking method is implemented for switching more than one propulsion unit.

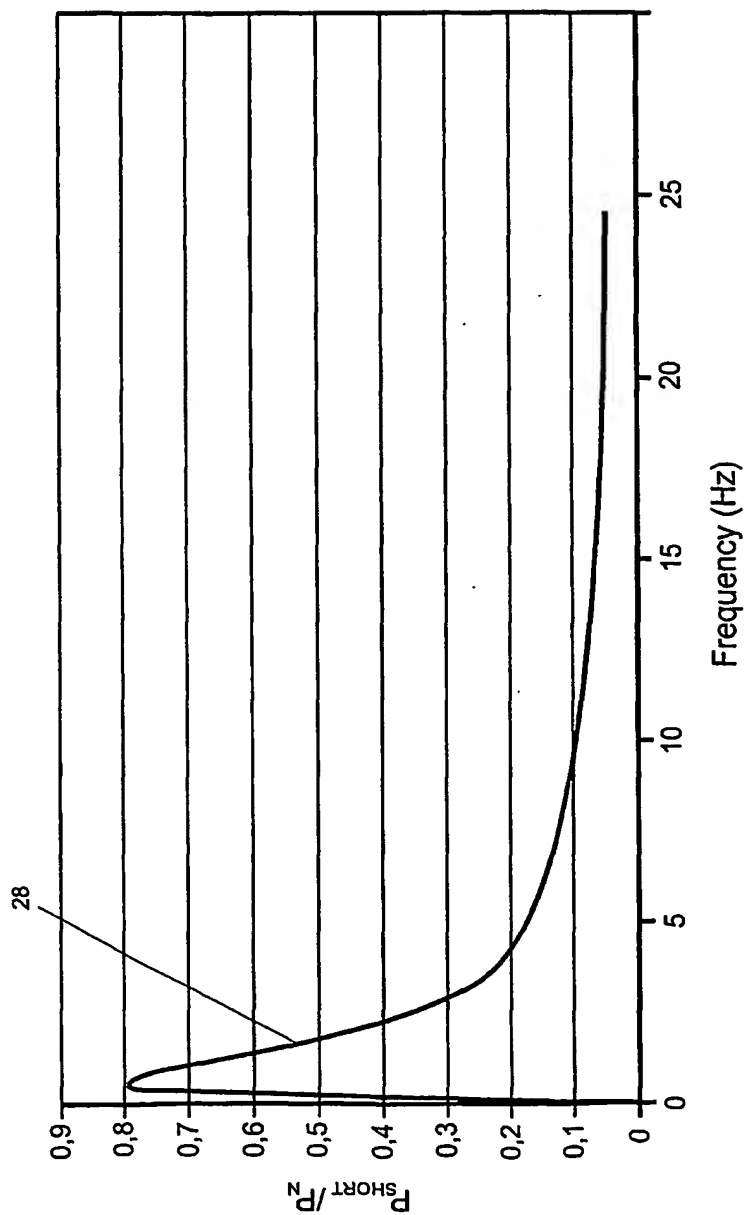


Fig. 5